US009122323B2

(12) **United States Patent**
Morris et al.

(10) **Patent No.: US 9,122,323 B2**
(45) **Date of Patent: Sep. 1, 2015**

(54) **SENSOR CONTROL**

(75) Inventors: **Julie Anne Morris**, Raleigh, NC (US); **James S. Rutledge**, Durham, NC (US); **Bradley Park Strazisar**, Cary, NC (US); **Aaron Michael Stewart**, Raleigh, NC (US); **Jay Wesley Johnson**, Raleigh, NC (US)

(73) Assignee: **Lenovo (Singapore) Pte. Ltd.**, Singapore (SG)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 498 days.

(21) Appl. No.: **12/943,777**

(22) Filed: **Nov. 10, 2010**

(65) **Prior Publication Data**

US 2012/0112998 A1 May 10, 2012

(51) **Int. Cl.**
G06F 3/0354 (2013.01)
G06F 1/16 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 3/03547*** (2013.01); ***G06F 1/169*** (2013.01); ***G06F 1/1662*** (2013.01); *G06F 2203/0338* (2013.01)

(58) **Field of Classification Search**
CPC G09G 5/00; G06F 3/02; G06F 3/0213; G06F 3/03547; G06F 1/1662; G06F 1/169; G06F 2203/0338
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,538,636	B1 *	3/2003	Harrison	345/156
6,552,713	B1 *	4/2003	Van Brocklin et al.	345/157
6,630,922	B2 *	10/2003	Fishkin et al.	345/156
6,697,054	B1 *	2/2004	Kamizono	345/168
7,154,480	B2 *	12/2006	Iesaka	345/173
2003/0117370	A1 *	6/2003	Van Brocklin et al.	345/156
2006/0244727	A1 *	11/2006	Salman et al.	345/168
2010/0026626	A1 *	2/2010	Macfarlane	345/160
2010/0315340	A1 *	12/2010	Wolff-Peterson et al.	345/163
2012/0038674	A1 *	2/2012	Stergiou et al.	345/650
2012/0194478	A1 *	8/2012	Liu et al.	345/175

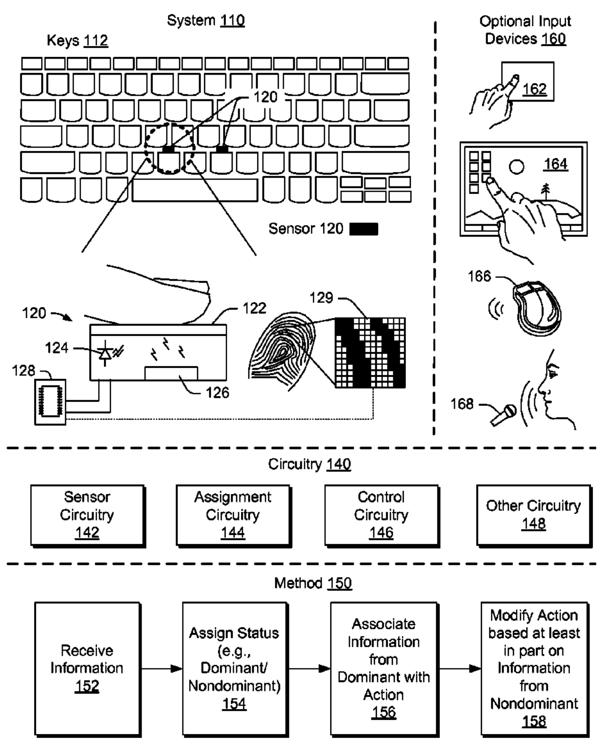
* cited by examiner

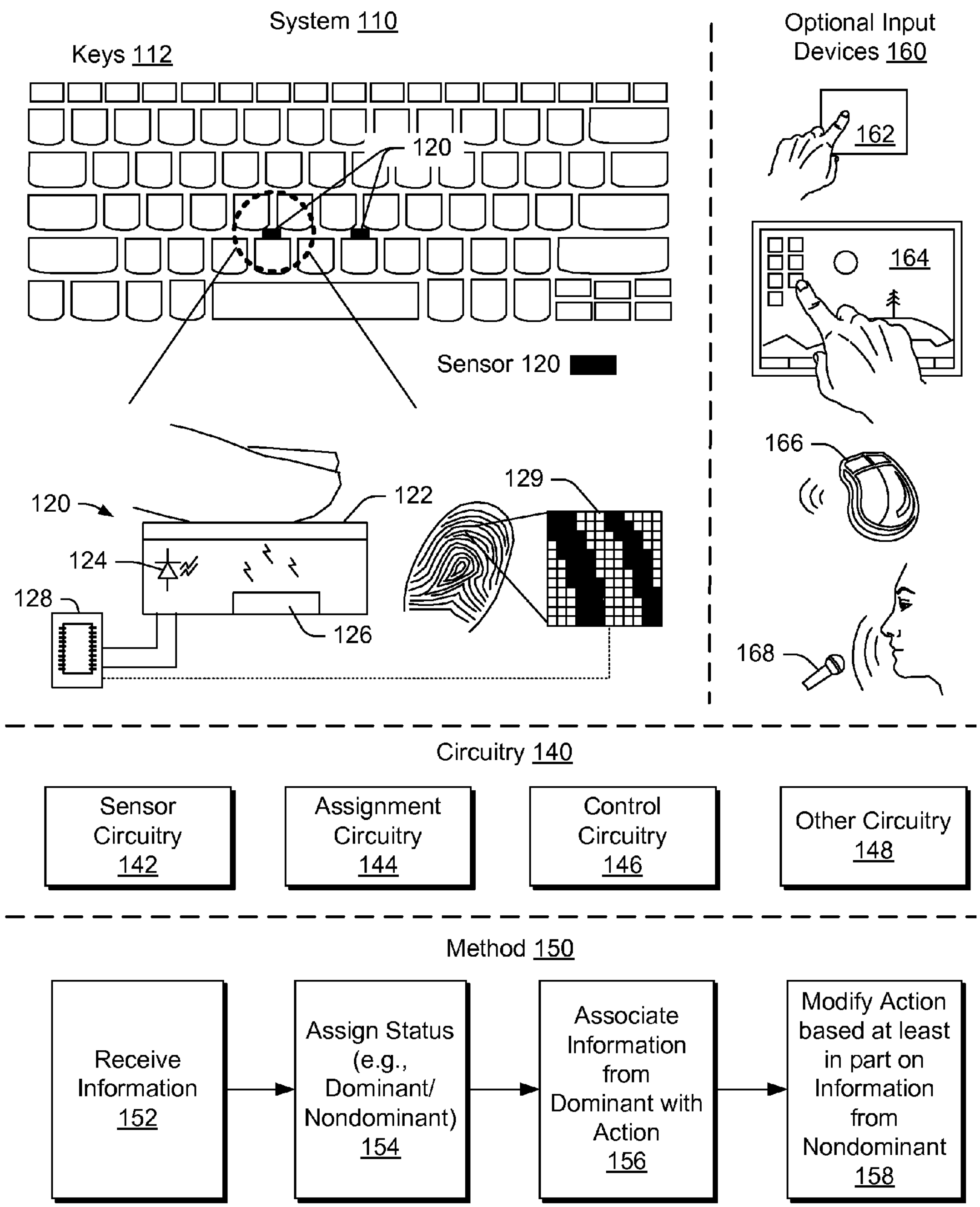
Primary Examiner — William Boddie
Assistant Examiner — Bryan Earles
(74) *Attorney, Agent, or Firm* — Brian J. Pangrle

(57) **ABSTRACT**

An apparatus includes sensors configured to sense optical information, assignment circuitry configured to assign a dominant status to one of the sensors and a nondominant status to another one of the sensors and control circuitry configured to output one or more commands based on sensed optical information and status. Various other apparatuses, systems, methods, etc., are also disclosed.

10 Claims, 8 Drawing Sheets





System 110
Keys 112
120
Sensor 120
120
122
124
128
126
129
Optional Input Devices 160
162
164
166
168
Circuitry 140
Sensor Circuitry 142
Assignment Circuitry 144
Control Circuitry 146
Other Circuitry 148
Method 150
Receive Information 152
Assign Status (e.g., Dominant/ Nondominant) 154
Associate Information from Dominant with Action 156
Modify Action based at least in part on Information from Nondominant 158

FIG. 1

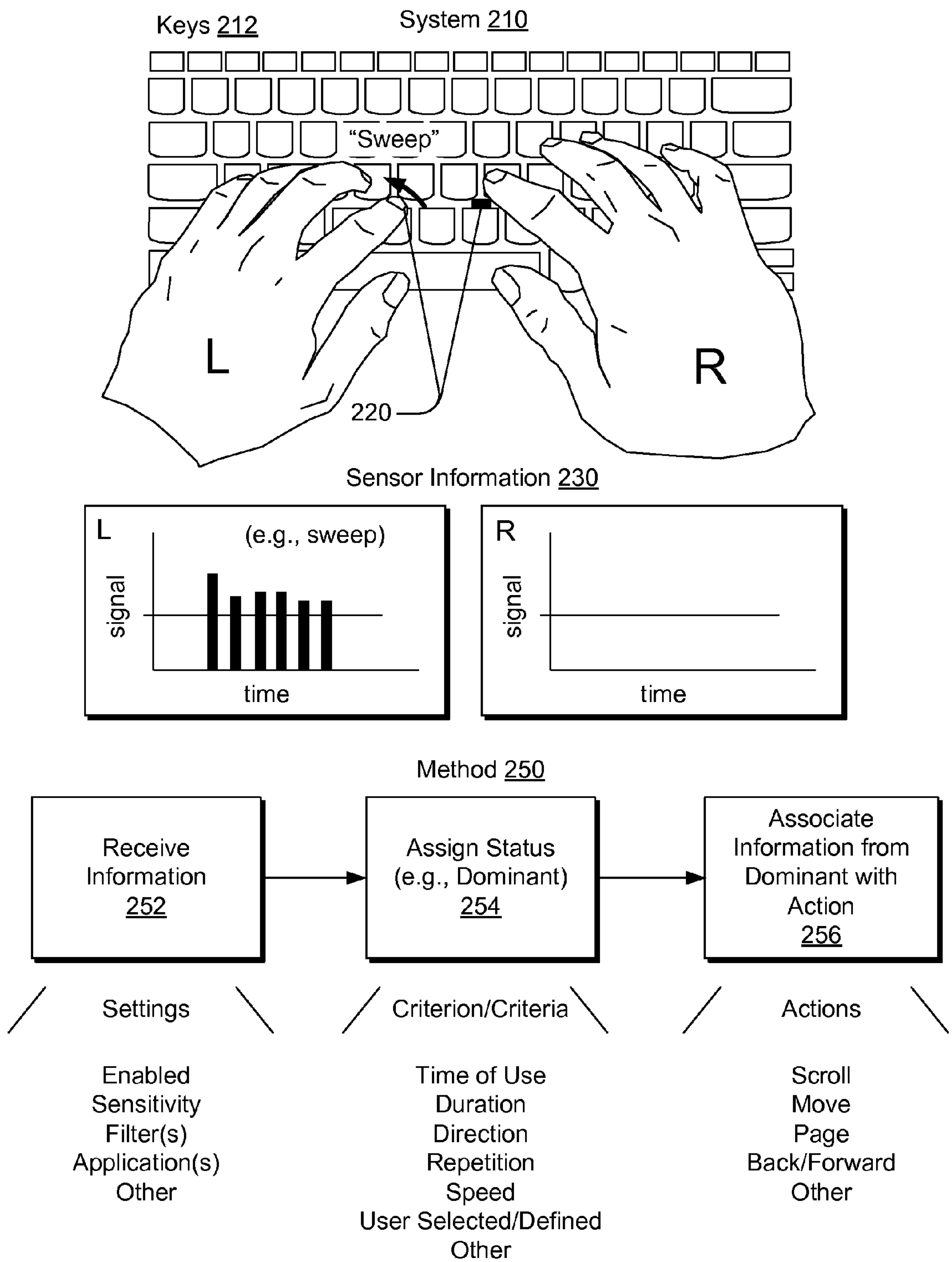

Keys 212
System 210
"Sweep"
L
R
220
Sensor Information 230
L
(e.g., sweep)
signal
time
R
signal
time
Method 250
Receive Information 252
Assign Status (e.g., Dominant) 254
Associate Information from Dominant with Action 256
Settings
Enabled
Sensitivity
Filter(s)
Application(s)
Other
Criterion/Criteria
Time of Use
Duration
Direction
Repetition
Speed
User Selected/Defined
Other
Actions
Scroll
Move
Page
Back/Forward
Other

FIG. 2

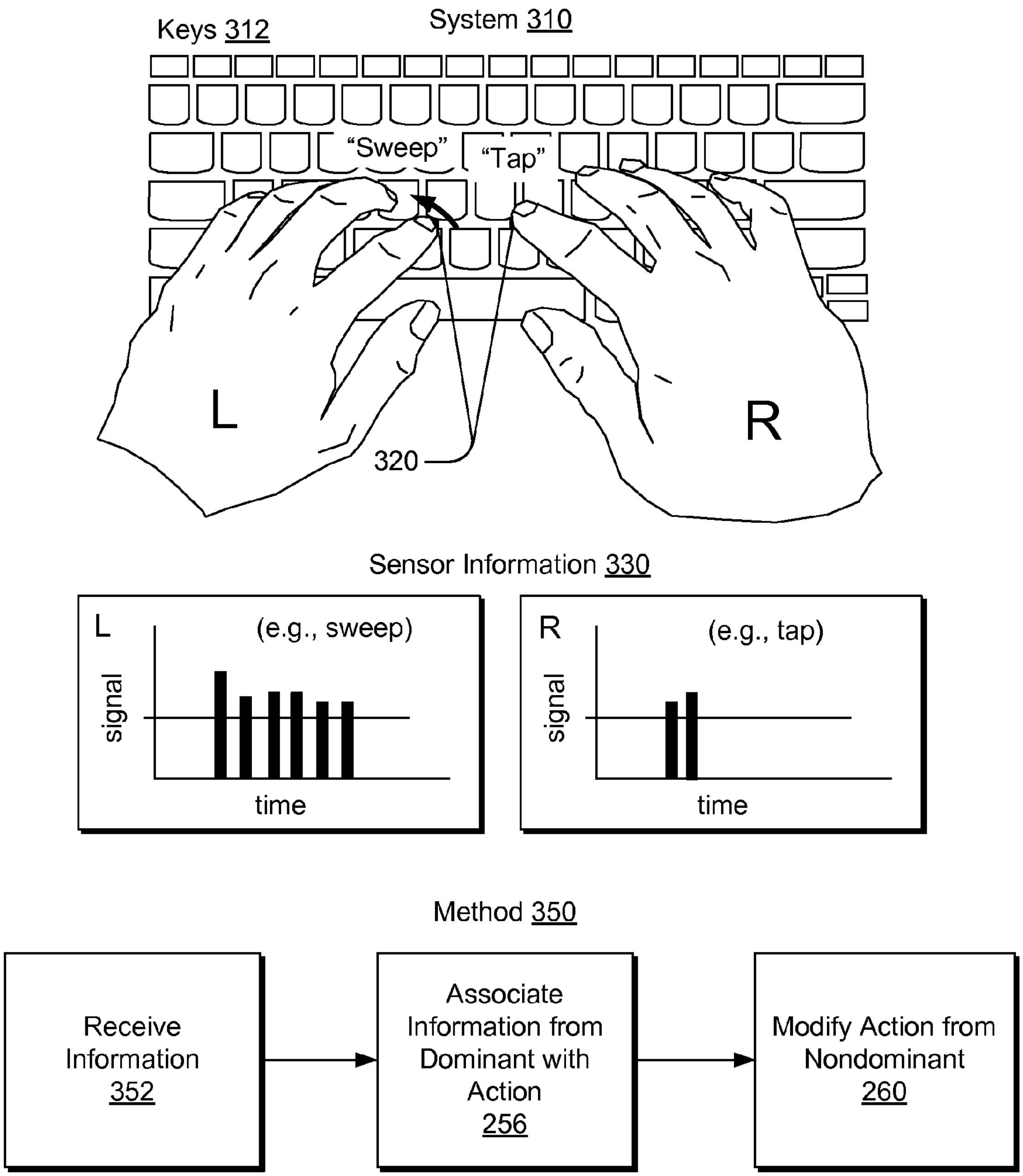

Keys 312
System 310
"Sweep"
"Tap"
L
R
320
Sensor Information 330
L
(e.g., sweep)
signal
time
R
(e.g., tap)
signal
time
Method 350
Receive Information 352
Associate Information from Dominant with Action 256
Modify Action from Nondominant 260

FIG. 3

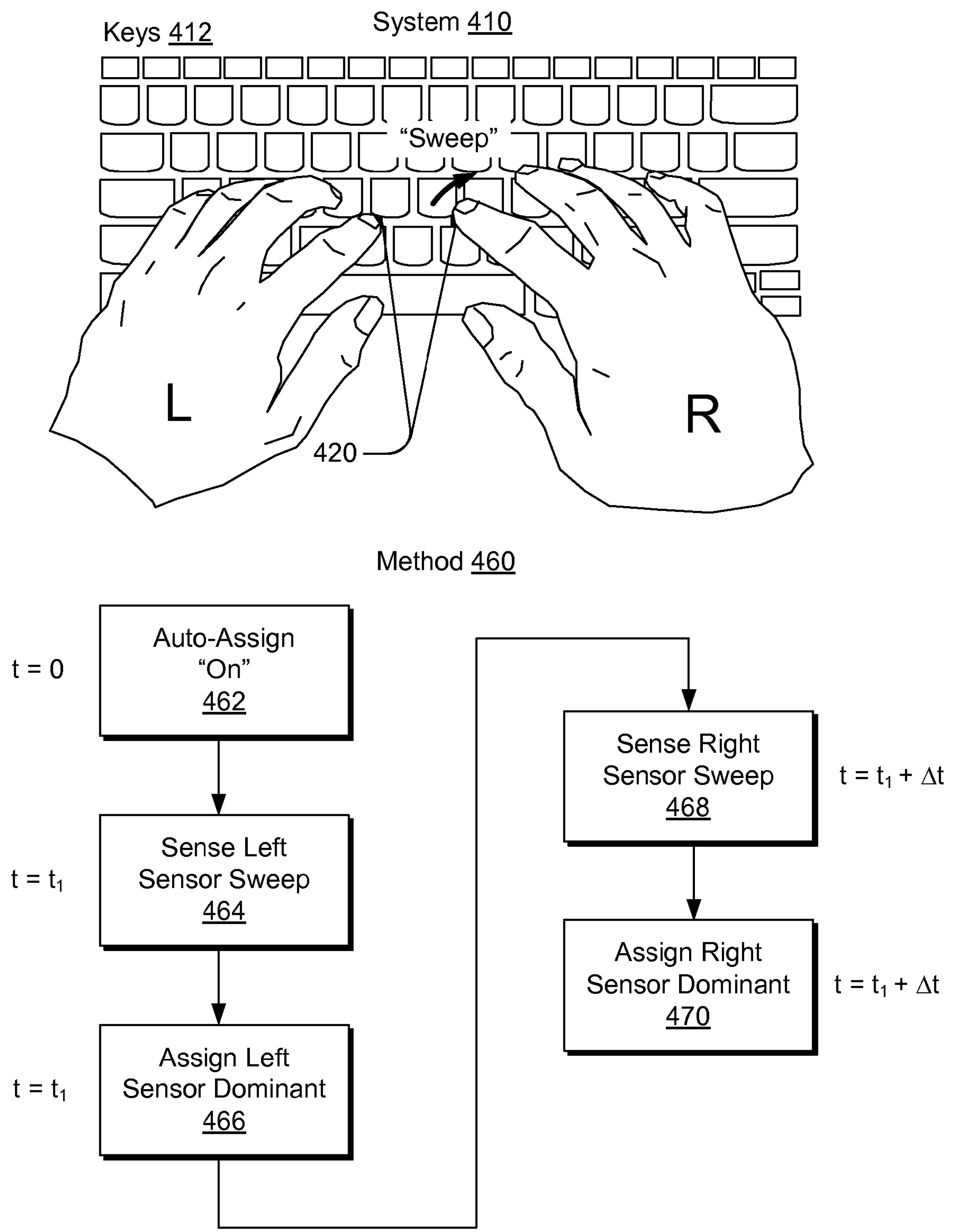

Keys 412
System 410
"Sweep"
L
R
420
Method 460
t = 0
Auto-Assign "On" 462
t = t_1
Sense Left Sensor Sweep 464
t = t_1
Assign Left Sensor Dominant 466
Sense Right Sensor Sweep 468
t = t_1 + Δt
Assign Right Sensor Dominant 470
t = t_1 + Δt

FIG. 4

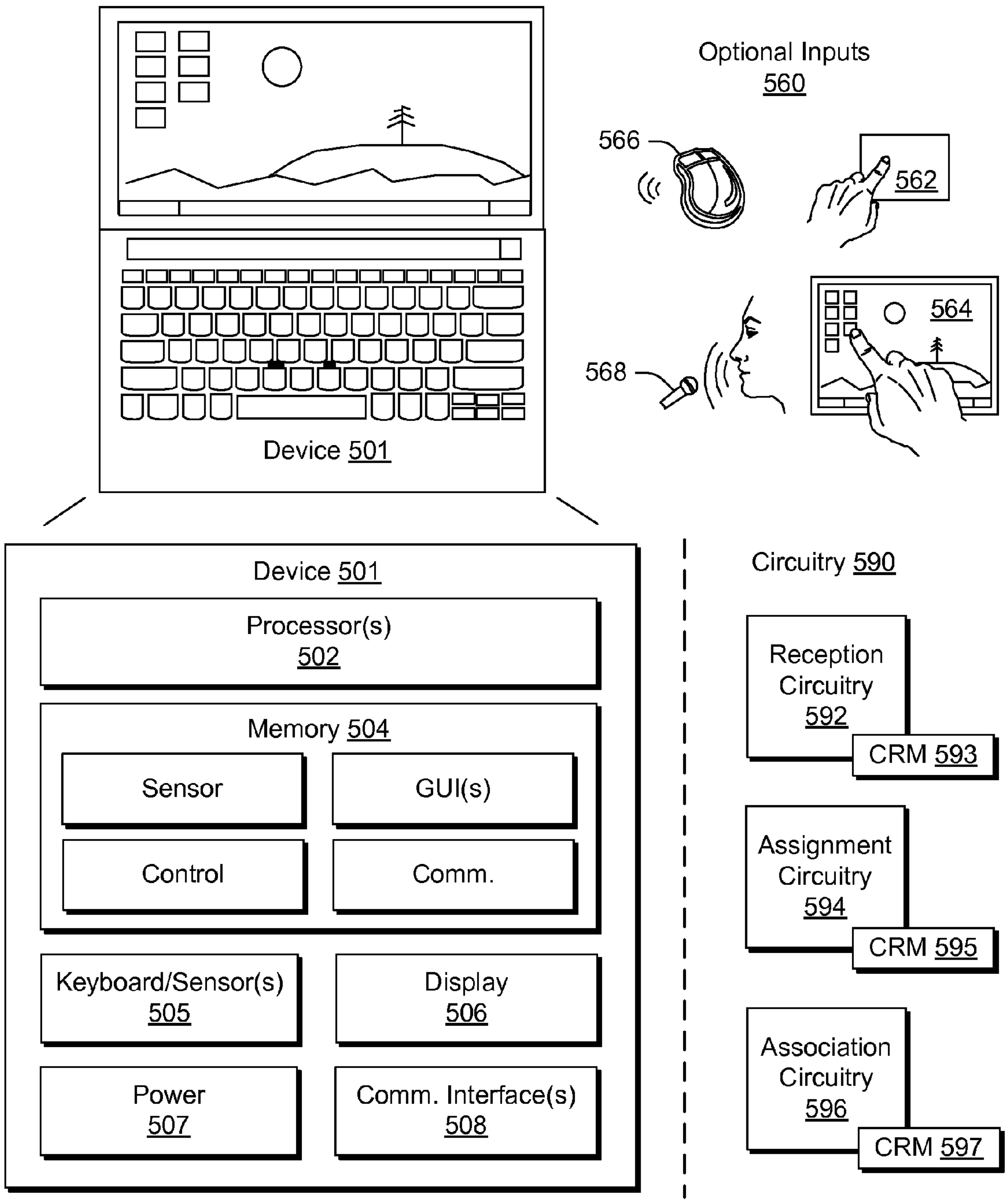
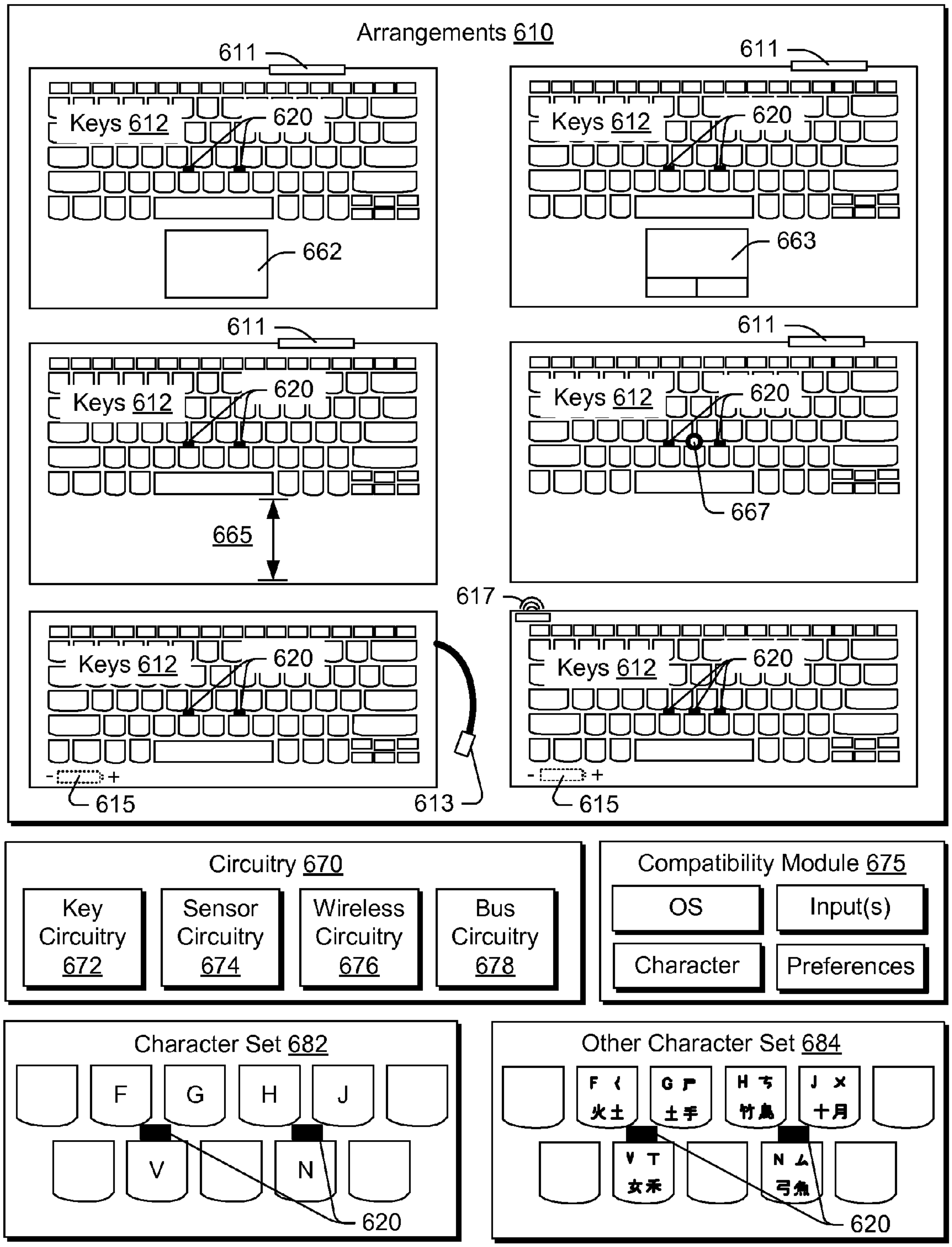

Optional Inputs
560
566
562
568
564
Device 501
Device 501
Processor(s)
502
Memory 504
Sensor
GUI(s)
Control
Comm.
Keyboard/Sensor(s)
505
Display
506
Power
507
Comm. Interface(s)
508
Circuitry 590
Reception
Circuitry
592
CRM 593
Assignment
Circuitry
594
CRM 595
Association
Circuitry
596
CRM 597

FIG. 5



Arrangements 610
611
Keys 612
620
662
663
665
667
617
613
615
Circuitry 670
Key Circuitry 672
Sensor Circuitry 674
Wireless Circuitry 676
Bus Circuitry 678
Compatibility Module 675
OS
Input(s)
Character
Preferences
Character Set 682
F
G
H
J
V
N
Other Character Set 684

FIG. 6

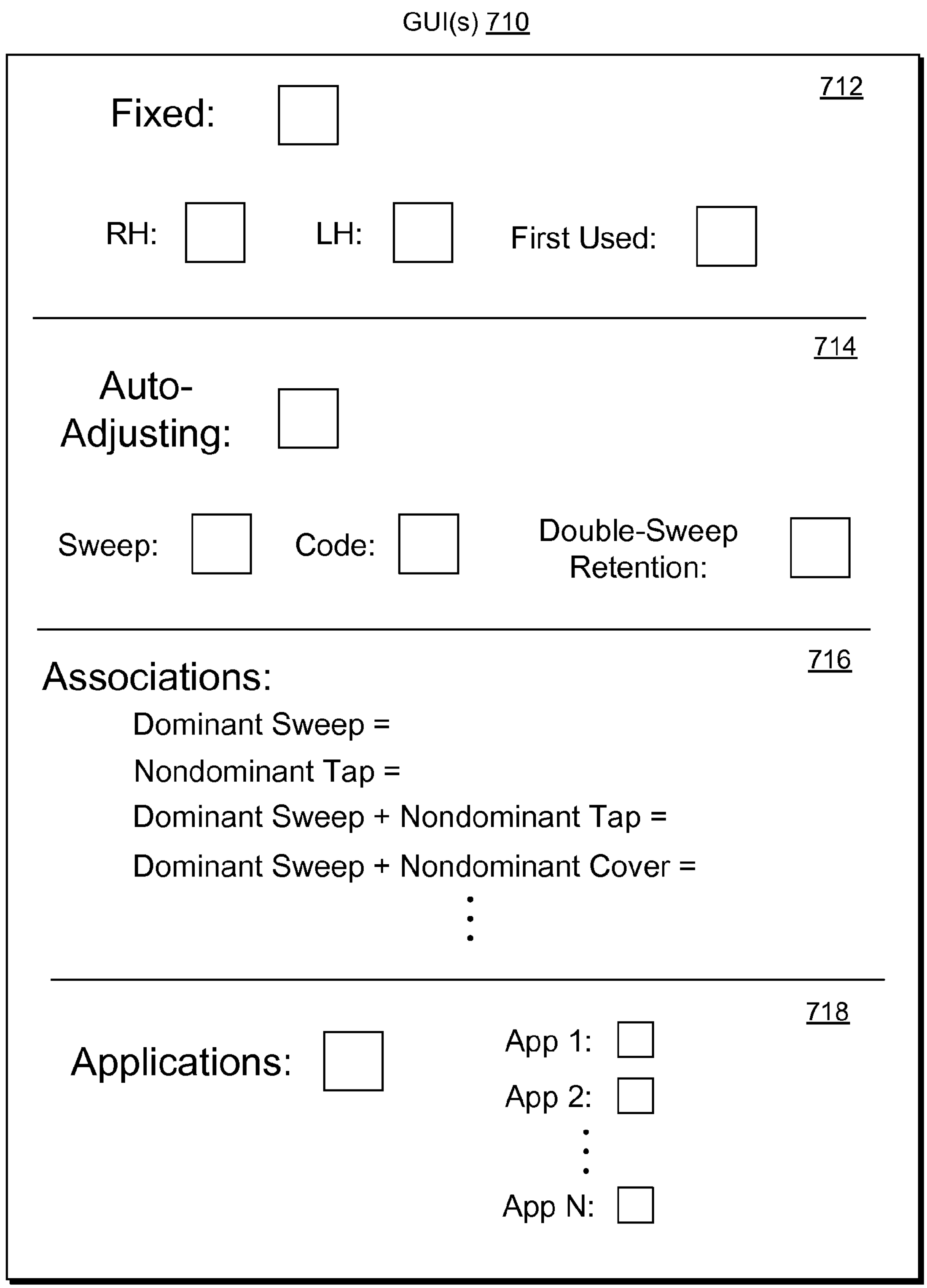

GUI(s) 710
712
Fixed:
RH:
LH:
First Used:
714
Auto-Adjusting:
Sweep:
Code:
Double-Sweep Retention:
716
Associations:
Dominant Sweep =
Nondominant Tap =
Dominant Sweep + Nondominant Tap =
Dominant Sweep + Nondominant Cover =
718
Applications:
App 1:
App 2:
App N:

FIG. 7

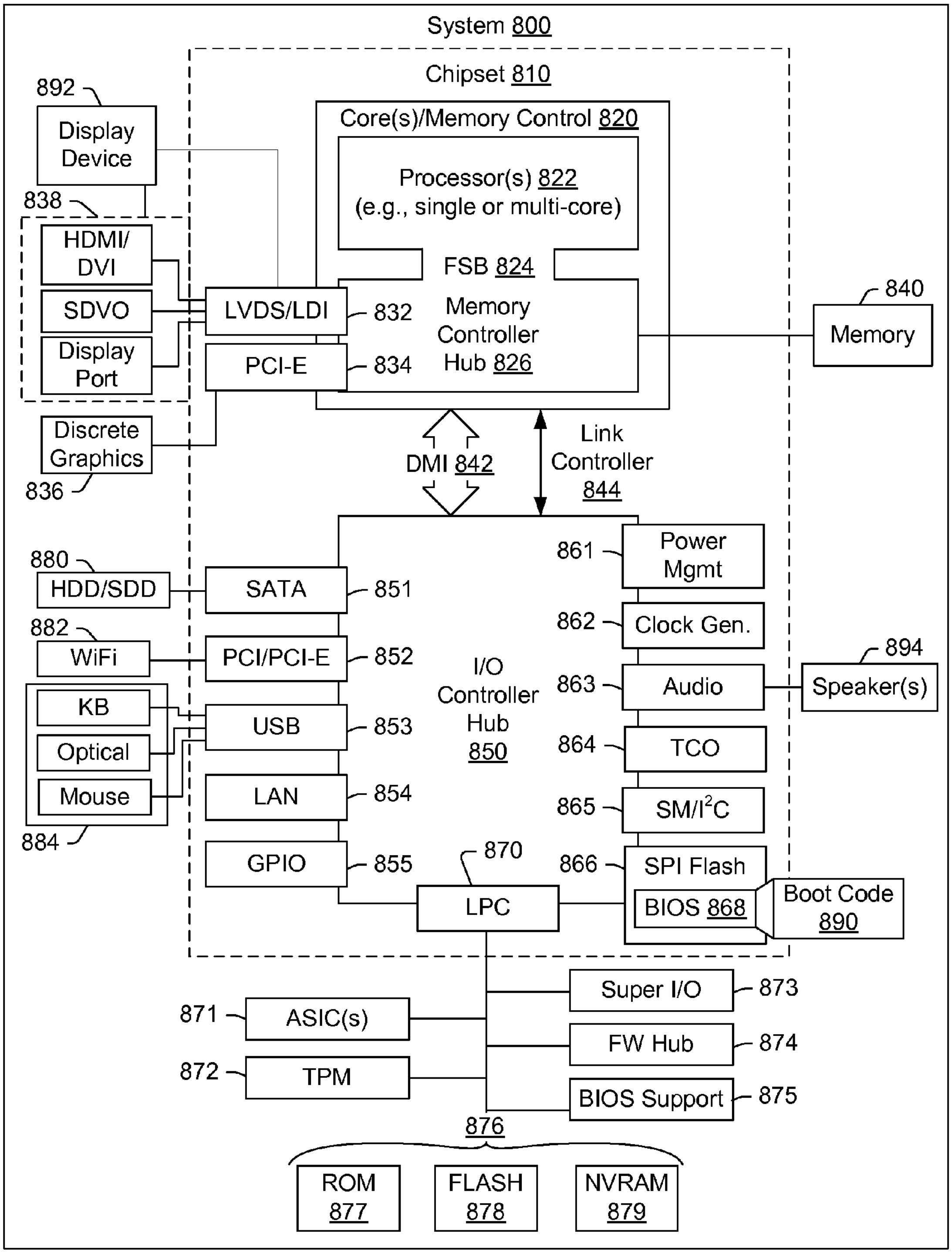

System 800
Chipset 810
Core(s)/Memory Control 820
Processor(s) 822
(e.g., single or multi-core)
FSB 824
Memory Controller Hub 826
892
Display Device
838
HDMI/ DVI
SDVO
Display Port
LVDS/LDI
832
PCI-E
834
Discrete Graphics
836
840
Memory
DMI 842
Link Controller 844
I/O Controller Hub 850
880
HDD/SDD
SATA
851
882
WiFi
PCI/PCI-E
852
KB
Optical
Mouse
884
USB
853
LAN
854
GPIO
855
870
LPC
861
Power Mgmt
862
Clock Gen.
863
Audio
894
Speaker(s)
864
TCO
865
SM/I2C
866
SPI Flash
BIOS 868
Boot Code 890
871
ASIC(s)
872
TPM
Super I/O
873
FW Hub
874
BIOS Support
875
876
ROM 877
FLASH 878
NVRAM 879

FIG. 8

SENSOR CONTROL

TECHNICAL FIELD

Subject matter disclosed herein generally relates to techniques for controlling sensors.

BACKGROUND

A user of computer keyboard may be right hand dominant, left hand dominant or ambidextrous. Various keyboards are used in conjunction with other input devices such as a mouse, which is typically placed to the right of the keyboard or the left of the keyboard. Newer types of input devices are emerging, some of which are fixed (e.g., integrated into a keyboard). As described herein, various technologies provide for enhanced control of input device that are associated with a keyboard.

SUMMARY

An apparatus includes sensors configured to sense optical information, assignment circuitry configured to assign a dominant status to one of the sensors and a nondominant status to another one of the sensors and control circuitry configured to output one or more commands based on sensed optical information and status. Various other apparatuses, systems, methods, etc., are also disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the described implementations can be more readily understood by reference to the following description taken in conjunction with examples of the accompanying drawings.

FIG. **1** is a series of diagrams of examples of a system, optional inputs, circuitry, and a method;

FIG. **2** is a series of diagrams of examples of a system, sensor information and a method;

FIG. **3** is a series of diagrams of examples of a system, sensor information and a method;

FIG. **4** is a series of diagrams of examples of a system and a method;

FIG. **5** is a series of diagrams of examples of a device, optional inputs and circuitry;

FIG. **6** is a series of diagrams of examples of arrangements, circuitry, modules and character sets;

FIG. **7** is a diagram of an example of a graphical user interface; and

FIG. **8** is a diagram of an example of a machine.

DETAILED DESCRIPTION

The following description includes the best mode presently contemplated for practicing the described implementations. This description is not to be taken in a limiting sense, but rather is made merely for the purpose of describing the general principles of the implementations. The scope of the invention should be ascertained with reference to the issued claims.

FIG. **1** shows an example of a system **110** that includes keys **112** and sensors **120**. As shown, the system **110** is arranged as a computer keyboard with various character keys **112** and two sensors **120**. Each of the sensors **120** may be configured as a so-called "optical trackpad". An optical trackpad is generally a sensor shaped as a "pad" configured to track an object using optical components. As described herein, tracking can

include, for example, detecting presence or an object or objects, absence of an object or objects or motion of an object or objects.

An approximate diagram of an example of the sensor **120** is shown in FIG. **1**. In the example of FIG. **1**, the sensor **120** includes a surface **122**, an emitter **124**, a detector **126**, and circuitry **128**, which may be configured to output sensed information in the form of a digital array **129**. For example, an object may be a finger or other object with surface indicia (e.g., consider fingerprint ridges, striations, or other indicia). When such an object contacts or comes into close proximity to the surface **122**, surface indicia of the object are illuminated by radiation emitted by the emitter **124** (e.g., an emitting diode). Radiation reflected by the object (e.g., optionally due to impedance/index of refraction changes of a boundary of the surface **122**) is detected by the detector **126**. The detector **126** may be a CCD or other type of detector.

With respect to the circuitry **140**, as described herein, sensor circuitry **142** may include a sensor, sensors or circuitry configured to receive information directly or indirectly from one or more sensors. Sensor circuitry **142** may include a multiplexer configurable to receive information from one or more sensors (e.g., a left sensor, a right sensor or both a left sensor and a right sensor). Sensor circuitry **142** may include one or more of an amplifier, a filter, or other component(s) for processing information. Sensor circuitry **142** may conform to one or more communication standards (e.g., bus, wired, wireless, etc.).

As described herein, a sensor or sensor circuitry may operate according to one or more algorithms that can output information that corresponds to planar coordinates (e.g., x, y). For example, a sensor or sensor circuitry may output one or more x, y, Δx, Δy, etc., values. A sensor or sensor circuitry may include a sampling rate such that, for example, values for x, y, Δx, Δy, etc., may be determined with respect to time.

As described herein, assignment circuitry **144** is configured to assign status to one or more sensors. For example, status may be "right", "left", "dominant", "nondominant", "enabled", "disabled", "filtered", "unfiltered", etc. In the example of FIG. **1**, control circuitry **146** is optionally configured to receive one or more status indicators for one or more sensors. For example, where one of the sensors **120** is assigned a dominant status by the assignment circuitry **144** and the other one of the sensors **120** is assigned a nondominant status by the assignment circuitry **144**, the control circuitry **146** may respond to sensed information from one or more of the sensors **120** based at least in part on assigned status. As described herein, the assignment circuitry **144** may assign status to one or more sensors based at least in part on information sensed by one or more sensors. In FIG. **1**, other circuitry **148** may be configured to operate in conjunction with the sensor circuitry **142**, the assignment circuitry **144** or the control circuitry **146**.

In FIG. **1**, a method **150** includes a reception block **152** for receiving information, an assignment block **154** for assigning a dominant status and a nondominant status (e.g., optionally by default), an association block **156** for associating information from a dominant sensor with an action and a modification block **158** for modifying the action based on information from a nondominant sensor. For example, sweeping a finger over a right sensor may result in the assignment block **154** assigning the right sensor a dominant status and assigning a left sensor a nondominant status. In such an example, subsequent sweeping of a finger over the dominant sensor may cause the association block **156** to associate information from the dominant sensor with a pan (or other) action. Where another finger is placed over the nondominant sensor, the modification block **158** may cause the pan (or other) action to be modified, for example, by causing selection of a graphical object rendered to a display and movement of the selected graphical object based on information generated by the sweeping of the finger over the dominant sensor. In other words, a simple sweep over a dominant sensor may pan, for example, an image rendered to a display whereas placement of a finger over a nondominant sensor may select an image rendered to a display and the sweep over the dominant sensor move the rendered image on the display. In another example, simultaneous sweeping of a finger over the dominant sensor and sweeping of a finger over the nondominant sensor may be associated with a "gesture", for example, to zoom where the amount of zoom is controlled by information sensed by the dominant sensor (e.g., speed of sweep, degree of sweep, etc.).

FIG. **1** also shows various optional input devices **160**, including a touchpad **162**, a touchscreen **164**, a mouse **166** and a microphone **168**. Such devices may be optionally used in conjunction with one or more of the sensors **120**.

FIG. **2** shows an example of a system **210** that includes keys **212** and left and right optical sensors **220**. In the example of FIG. **2**, a user's left index finger (e.g., an object) sweeps past the left optical sensor. In response, the left optical sensor provides sensor information **230** such as a signal with respect to time indicative of the sweeping motion of the left index finger. For example, the left optical sensor may output a signal that depends on how many fingerprint ridges were detected across a particular portion of the sensor's field of view, alternatively, the signal may depend on tracking one or more ridges or portions thereof. As shown, the user's right index finger is not in contact with the right optical sensor. Accordingly, the right optical sensor provides no signal or other information indicative of absence of an object in the right optical sensor's field of view.

FIG. **2** also shows an example of a method **250** that includes a reception block **252** for receiving sensor information, an assignment block **254** for assigning status to one or more sensors and an association block **256** for associating sensed information with an action based at least in part on status. For example, where a user sweeps one of her five fingers over the left optical sensor, the left optical sensor may be assigned a dominant status, which may correspond to the user's dominant hand, and, for example, where another user sweeps one of his five fingers over the right optical sensor, the right optical sensor may be assigned a dominant status, which may correspond to the user's dominant hand. Accordingly, as described herein, a system with keys and sensors may (e.g., via a simple finger sweep) accommodate a left hand dominant user and accommodate a right hand dominant user.

As described herein, one or more settings may be set that have at least some relationship to a sensor or sensed information (e.g., via one or more of sensor circuitry, assignment circuitry, control circuitry, or other circuitry). In the example of FIG. **2**, settings may include one or more of an enable/disable setting, a sensitivity setting, a filter setting, an application specific setting, or another setting.

As described herein, an assignment process (e.g., implemented via one or more of sensor circuitry, assignment circuitry, control circuitry, or other circuitry) may assign status based on a criterion or criteria such as one or more of a time of use criterion, a duration criterion, a direction criterion, a repetition criterion, a speed criterion, a user selected/defined criterion or another criterion.

As described herein, an association process (e.g., implemented via one or more of sensor circuitry, assignment circuitry, control circuitry, or other circuitry) may associate sensed information, based at least in part on status, with an action such as, for example, a scroll action, a move action, a page change action, a back action, a forward action or another action.

FIG. **3** shows an example of a system **310** that includes keys **312** and left and right optical sensors **320**. In the example of FIG. **3**, a user's left index finger (e.g., an object) sweeps past the left optical sensor and the user's right index finger (e.g., an object) taps the right optical sensor. In response, the left optical sensor provides sensor information **330** such as a signal with respect to time indicative of the sweeping motion of the left index finger and the right optical sensor provides sensor information **330** indicative of the tap.

FIG. **3** also shows an example of a method **350** that includes a reception block **352** for receiving sensor information, an association block **256** for associating sensed information from a sensor with a dominant status with an action and a modification block **260** for modifying the action based at least in part on sensed information from a sensor with a nondominant status.

As described herein, a method can include receiving information from an optical sensor, responsive to receipt of the information, assigning the optical sensor as a dominant optical sensor and assigning another optical sensor as a nondominant optical sensor and associating information received from the dominant optical sensor with an action and modifying the action based at least in part on information received from the nondominant optical sensor. In such a method, the assigning may include assigning the dominant optical sensor as corresponding to dominant handedness of a user. As described herein, receiving a signal may include receiving a signal corresponding to sweeping of an object across the optical sensor. As described herein, reassigning a dominant optical sensor as a nondominant optical sensor may occur based at least in part on input from the nondominant optical sensor.

FIG. **4** shows an example of a system **410** that includes keys **412** and left and right optical sensors **420**. In the example of FIG. **4**, at a time of $t=t_1$, a user's left index finger (e.g., an object) sweeps past the left optical sensor and, at a time of $t=t_1+\Delta t$, a user's right index finger (e.g., an object) sweeps past the right optical sensor.

FIG. **4** also shows an example of a method **460** that covers times t_1 and $t_1+\Delta t$. In an enablement block **462**, at time $t=0$, an automatic assignment functionality is enabled (e.g., turned "on"). In a sense block **464**, at time $t=t_1$, a sweeping motion is sensed by a left sensor. In response to the sensed sweeping action, an assignment block assigns the left sensor a dominant status. At a later time, $t=t_1+\Delta t$, in a sense block **468**, a sweeping motion is sensed by a right sensor. In response to the sensed sweeping action, an assignment block **470** assigns the right sensor a dominant status (e.g., which re-assigns the left sensor to a nondominant status). Accordingly, in such a method a user can change the status of one or more sensors.

FIG. **5** shows an example of a device **501**, some examples of circuitry **590** that may be included in the device **501** and some other, optional input devices **560**. In the example of FIG. **5**, the device **501** includes one or more processors **502** (e.g., cores), memory **504**, a keyboard with one or more sensors **505**, a display **506**, a power supply **507** and one or more communication interfaces **508**. As described herein, a communication interface may be a wired or a wireless interface. In the example of FIG. **5**, the memory **504** can include one or more modules such as, for example, a sensor module, a control module, a GUI module and a communication module. Such modules may be provided in the form of instructions, for example, directly or indirectly executable by the one or more processors **502**.

The device **501** may include the circuitry **590**. In the example of FIG. **5**, the circuitry **590** includes reception circuitry **592**, assignment circuitry **594** and association circuitry **596**. Such circuitry may optionally rely on one or more computer-readable media that includes computer-executable instructions. For example, the reception circuitry **592** may rely on CRM **593**, the assignment circuitry **594** may rely on CRM **595** and the association circuitry **596** may rely on CRM **597**. While shown as separate blocks, CRM **593**, CRM **595** and CRM **597** may be provided as a package (e.g., optionally in the form of a single computer-readable storage medium). As described herein, a computer-readable medium may be a storage device (e.g., a memory card, a storage disk, etc.) and referred to as a computer-readable storage medium.

As described herein, the device **501** may include or be part of a system that includes one or more of a touchpad **562**, a touchscreen **564**, a mouse **566** or a microphone **568**. The device **501** may include or be part of a system that includes a video camera (e.g., a webcam), which may be configured to recognize or track user input.

As described herein, one or more computer-readable media can include computer-executable instructions to instruct a computer to receive a signal from an optical sensor, responsive to receipt of the signal, assign the optical sensor as a dominant optical sensor and assign another optical sensor as a nondominant optical sensor, associate input from the dominant optical sensor with an action, associate input from the nondominant optical sensor with an action and associate input from the dominant optical sensor and input from the nondominant optical sensor with an action. In such an example, the one or more computer-readable media may further include computer-executable instructions to instruct a computer to reassign the dominant optical sensor as a nondominant optical sensor based at least in part on input received from the nondominant optical sensor (see, e.g., the example method **460** of FIG. **4**).

FIG. **6** shows various examples of arrangements **610**, circuitry **670**, a compatibility module **675** and character sets **682** and **684**. In the various arrangements **610**, a system with keys **612** and sensors **620** may optionally include one or more of an interface **611**, a touchpad **662**, a touchpad with associated buttons **663**, a hand rest **665**, a joystick **667**, a communication cable **613** (e.g., USB or other, optionally configured to supply power), a power supply **615** (e.g., one or more batteries) and a wireless communication interface **617**. As indicated, an arrangement may include more than two optical sensors (see, e.g., lower left example arrangement).

As described herein, a system may include the circuitry **670**, which may include one or more of key circuitry **672**, sensor circuitry **674**, wireless communication circuitry **676** and bus circuitry **678**.

As described herein, a compatibility module may be provided to allow for compatibility of a system. For example, the compatibility module **675** can include operating system (OS) compatibility configuration instructions, character set configuration instructions, input compatibility configuration instructions, preference configuration instructions, etc.

In the example of FIG. **6**, the character set **682** includes F, G and V keys and H, J and N keys and left and right optical sensors **620**. In this example, a left optical sensor is positioned adjacent to at least one or more of an F key, a G key and a V key and a right optical sensor is positioned adjacent to at least one or more of an H key, a J key and a N key. In the example of one or more additional or other character set **684**, a left optical sensor is positioned adjacent to three keys and a right optical sensor is positioned adjacent to three keys. As described herein, one or more optical sensors may be positioned adjacent to one or more keys and generally at least two keys of a keyboard associated with one or more character sets.

FIG. **7** shows various example graphical user interfaces (GUIs) **710**. As described herein, a device (e.g., the device **501** of FIG. **5**) may include circuitry configured for presentation of one or more GUIs. In the example of FIG. **7**, a GUI may include fixed GUI controls **712**, auto-adjusting GUI controls **714**, association GUI controls **716**, application GUI controls **718** or one or more additional or other GUI controls.

As to the fixed GUI controls **712**, a device may receive information to select a "fixed" option that instructs the device to fix a right optical sensor as dominant, to fix a left optical sensor as dominant or to optionally assign a first used optical sensor as dominant.

As to the auto-adjusting GUI controls **714**, a device may receive information to select an auto-adjusting option that instructs the device to assign optical sensor status (e.g., dominant or nondominant) based on a sweep or a code (e.g., tap, sweep, tap). Such a GUI controls **714** may include a double-sweep retention option where upon sensing of substantially simultaneous sweeps, assignment status remains unchanged (e.g., if a right optical sensor was assigned a dominant status, a double-sweep of both right and left optical sensors would not change the dominant status of the right optical sensor).

As to the associations GUI controls **716**, default associations may be set. However, options may exist for receipt of input to associate actions with sensed information. For example, sensed information indicative of a dominant sweep, a nondominant sweep, a dominant tap, a nondominant tap, a dominant sweep and a nondominant tap, a dominant sweep and a nondominant cover, etc., may be associated with one or more actions, which may be selected, for example, based on user input.

As to the applications GUI controls **718**, an option may exist to link one or more optical sensors, or responses to sensed information, to one or more applications. In such an example, each application may have associations specific to that application. For example, a media player application may include associations such as dominant sweep to the right corresponds to a forward media action and a dominant sweep to the left corresponds to a rewind media action. In such an example, a cover of a nondominant sensor during a sweep may correspond to a fast forward media action or a fast rewind media action. For a game application, various associations may be set to allow for enhanced interaction with the game application (e.g., avatar movements, actions, etc.).

As described herein, in a fixed mode of operation, a first sensor used to move a cursor rendered to a display can be assigned a primary or dominant status. In such an example, another sensor may be assigned a modifier or nondominant status. As described herein, to move a cursor, a user can sweep his finger over an optical sensor where, if the user uses the right optical sensor first, a status of "right handed" may be established and where, if the user uses the left optical sensor first, a status of "left handed" may be established. Such "first use" may be based on time of a start-up, resumption from a low power state, etc. As mentioned, an option may exist for a user to manually set or switch the handedness, if desired. As described herein, a process of determining primary and modifier can enable various uses of one or more input devices (e.g., optical sensors or other), including uses such as area selection, left and right clicks, select gestures, etc. As described herein, a device can include circuitry to assign a dominant status to a sensor where that sensor is a primary sensor and where another sensor with a nondominant status is a modifier sensor to modify output associated with the primary sensor.

In an example of an auto-adjusting assignment mode, a first optical sensor to be touched in a sweeping motion may be assigned a primary or dominant status. Such a sensor may retain its primary or dominant status until occurrence of a sweeping motion along another optical sensor. If a right optical sensor and a left optical sensor detect sweeping motion, such as during a gesture, then whichever sensor had primary or dominant status before the gesture keeps its primary or dominant status. As mentioned (see, e.g., the GUI **710**), a device may be configured to allow a user to optionally manually set handedness (e.g., status) and optionally disable an auto-detect feature or an auto-adjusting feature.

As described herein, a device can include sensors configured to sense optical information, assignment circuitry configured to assign a dominant status to one of the sensors and a nondominant status to another one of the sensors and control circuitry configured to output one or more commands based on sensed optical information and status. In such a device, the sensors may include a left sensor and a right sensor optionally where the dominant status sensor corresponds to a dominant hand of a user. While some examples refer to optical sensors, various techniques described herein may optionally be applied to one or more other types of sensors. For example, sensors positioned akin to the sensors **220**, **320**, **420** or **620** may be configured to sense capacitive information or one or more other types of information. As to capacitive information, a sensor may include one or more electrodes configured for formation of a virtual capacitor or virtual capacitors (e.g., where a human finger forms a virtual capacitor plate). For example, an appropriately timed sweeping action over an electrode array of a capacitive sensor may provide information sufficient for assignment of a dominant status to that sensor.

As described herein, a device can include assignment circuitry that includes circuitry to assign a dominant status to a sensor based on information received from one of two or more sensors. In such an example, the information received can correspond to a signal generated by the one of the sensors responsive to an object sweeping across that sensor (e.g., touching or in close proximity to the sensor) and may correspond to an initial session signal generated by the one of two or more sensors. As described herein, a device can include assignment circuitry that includes circuitry to reassign a nondominant status to a dominant status based on information received from one of two or more sensors.

In various examples, a keyboard (e.g., a computer keyboard) includes two or more sensors with, for example, at least two keys adjacent one of the sensors and at least two different keys adjacent another one of the sensors. As shown in the example character set **682** of FIG. **6**, at least two keys can include an F key and at least two different keys can include a J key.

As described herein, a device can include assignment circuitry that includes circuitry to assign a dominant status based on information associated with an assignment control of a graphical user interface (GUI).

The term "circuit" or "circuitry" is used in the summary, description, and/or claims. As is well known in the art, the term "circuitry" includes all levels of available integration, e.g., from discrete logic circuits to the highest level of circuit integration such as VLSI, and includes programmable logic components programmed to perform the functions of an embodiment as well as general-purpose or special-purpose processors programmed with instructions to perform those functions. Such circuitry may optionally rely on one or more computer-readable media that includes computer-executable instructions. As described herein, a computer-readable medium may be a storage device (e.g., a memory card, a storage disk, etc.) and referred to as a computer-readable storage medium.

While various examples of circuits or circuitry have been discussed, FIG. **8** depicts a block diagram of an illustrative computer system **800**. The system **800** may be a desktop computer system, such as one of the ThinkCentre® or ThinkPad® series of personal computers sold by Lenovo (US) Inc. of Morrisville, N.C., or a workstation computer, such as the ThinkStation®, which are sold by Lenovo (US) Inc. of Morrisville, N.C.; however, as apparent from the description herein, a satellite, a base, a server or other machine may include other features or only some of the features of the system **800**. As described herein, a device such as the device **501** may include at least some of the features of the system **800**.

As shown in FIG. **8**, the system **800** includes a so-called chipset **810**. A chipset refers to a group of integrated circuits, or chips, that are designed to work together. Chipsets are usually marketed as a single product (e.g., consider chipsets marketed under the brands INTEL®, AMD®, etc.).

In the example of FIG. **8**, the chipset **810** has a particular architecture, which may vary to some extent depending on brand or manufacturer. The architecture of the chipset **810** includes a core and memory control group **820** and an I/O controller hub **850** that exchange information (e.g., data, signals, commands, etc.) via, for example, a direct management interface or direct media interface (DMI) **842** or a link controller **844**. In the example of FIG. **8**, the DMI **842** is a chip-to-chip interface (sometimes referred to as being a link between a "northbridge" and a "southbridge").

The core and memory control group **820** include one or more processors **822** (e.g., single core or multi-core) and a memory controller hub **826** that exchange information via a front side bus (FSB) **824**. As described herein, various components of the core and memory control group **820** may be integrated onto a single processor die, for example, to make a chip that supplants the conventional "northbridge" style architecture.

The memory controller hub **826** interfaces with memory **840**. For example, the memory controller hub **826** may provide support for DDR SDRAM memory (e.g., DDR, DDR2, DDR3, etc.). In general, the memory **840** is a type of random-access memory (RAM). It is often referred to as "system memory".

The memory controller hub **826** further includes a low-voltage differential signaling interface (LVDS) **832**. The LVDS **832** may be a so-called LVDS Display Interface (LDI) for support of a display device **892** (e.g., a CRT, a flat panel, a projector, etc.). A block **838** includes some examples of technologies that may be supported via the LVDS interface **832** (e.g., serial digital video, HDMI/DVI, display port). The memory controller hub **826** also includes one or more PCI-express interfaces (PCI-E) **834**, for example, for support of discrete graphics **836**. Discrete graphics using a PCI-E interface has become an alternative approach to an accelerated graphics port (AGP). For example, the memory controller hub **826** may include a 16-lane (×16) PCI-E port for an external PCI-E-based graphics card. A system may include AGP or PCI-E for support of graphics.

The I/O hub controller **850** includes a variety of interfaces. The example of FIG. **8** includes a SATA interface **851**, one or more PCI-E interfaces **852** (optionally one or more legacy PCI interfaces), one or more USB interfaces **853**, a LAN interface **854** (more generally a network interface), a general purpose I/O interface (GPIO) **855**, a low-pin count (LPC) interface **870**, a power management interface **861**, a clock generator interface **862**, an audio interface **863** (e.g., for speakers **894**), a total cost of operation (TCO) interface **864**, a system management bus interface (e.g., a multi-master serial computer bus interface) **865**, and a serial peripheral flash memory/controller interface (SPI Flash) **866**, which, in the example of FIG. **8**, includes BIOS **868** and boot code **890**. With respect to network connections, the I/O hub controller **850** may include integrated gigabit Ethernet controller lines multiplexed with a PCI-E interface port. Other network features may operate independent of a PCI-E interface.

The interfaces of the I/O hub controller **850** provide for communication with various devices, networks, etc. For example, the SATA interface **851** provides for reading, writing or reading and writing information on one or more drives **880** such as HDDs, SDDs or a combination thereof. The I/O hub controller **850** may also include an advanced host controller interface (AHCI) to support one or more drives **880**. The PCI-E interface **852** allows for wireless connections **882** to devices, networks, etc. The USB interface **853** provides for input devices **884** such as keyboards (KB), one or more optical sensors (see, e.g., the sensor **120** of FIG. **1**), mice and various other devices (e.g., cameras, phones, storage, media players, etc.). On or more other types of sensors may optionally rely on the USB interface **853** or another interface (e.g., I^2C, etc.).

In the example of FIG. **8**, the LPC interface **870** provides for use of one or more ASICs **871**, a trusted platform module (TPM) **872**, a super I/O **873**, a firmware hub **874**, BIOS support **875** as well as various types of memory **876** such as ROM **877**, Flash **878**, and non-volatile RAM (NVRAM) **879**. With respect to the TPM **872**, this module may be in the form of a chip that can be used to authenticate software and hardware devices. For example, a TPM may be capable of performing platform authentication and may be used to verify that a system seeking access is the expected system.

The system **800**, upon power on, may be configured to execute boot code **890** for the BIOS **868**, as stored within the SPI Flash **866**, and thereafter processes data under the control of one or more operating systems and application software (e.g., stored in system memory **840**). An operating system may be stored in any of a variety of locations and accessed, for example, according to instructions of the BIOS **868**. Again, as described herein, a satellite, a base, a server or other machine may include fewer or more features than shown in the system **800** of FIG. **8**.

CONCLUSION

Although examples of methods, devices, systems, etc., have been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described. Rather, the specific features and acts are disclosed as examples of forms of implementing the claimed methods, devices, systems, etc.

What is claimed is:

1. An apparatus comprising:

a keyboard that comprises right and left optical sensors that sense optical information;

assignment circuitry that configures the right and left optical sensors as right hand dominant based on sensed optical information received from the right optical sensor that corresponds to an assignment criterion or as left hand dominant based on sensed optical information received from the left optical sensor that corresponds to the assignment criterion and that assigns, for a right hand dominant configuration, the right optical sensor to be a primary sensor and the left optical sensor to be a modifier sensor and, for a left hand dominant configuration, the left optical sensor to be the primary sensor and the right optical sensor to be the modifier sensor; and

control circuitry to output one or more commands according to a command correspondence based on sensed input optical information from the primary sensor and sensed input optical information from the modifier sensor; wherein the command correspondence is substantially the same for the right hand dominant configuration and for the left hand dominant configuration.

2. The apparatus of claim **1** wherein the information received corresponds to a signal generated by the one of the optical sensors responsive to an object sweeping across that optical sensor.

3. The apparatus of claim **1** wherein the information received corresponds to an initial session signal generated by the one of the optical sensors.

4. The apparatus of claim **1** comprising at least two keys adjacent one of the optical sensors and at least two different keys adjacent another one of the optical sensors.

5. The apparatus of claim **4** wherein the at least two keys comprise an F key and wherein the at least two different keys comprise a J key.

6. The apparatus of claim **1** wherein the keyboard comprises a computer keyboard.

7. The apparatus of claim **1** wherein the one or more commands comprise one or more cursor movement commands.

8. A method comprising:

receiving information from one of a right optical sensor of a keyboard and a left optical sensor of the keyboard

responsive to receipt of the information assigning the right and left optical sensors as right hand dominant based on sensed optical information received from the right optical sensor that corresponds to an assignment criterion or as left hand dominant based on sensed optical information received from the left optical sensor that corresponds to the assignment criterion and assigning, for a right hand dominant configuration, the right optical sensor to be a primary sensor and the left optical sensor to be a modifier sensor and, for a left hand dominant configuration, the left optical sensor to be the primary sensor and the right optical sensor to be the modifier sensor;

receiving information from the primary sensor and from the modifier sensor; and outputting one or more commands according to a command correspondence based on sensed input optical information from the primary sensor and sensed input optical information from the modifier sensor; wherein the command correspondence is substantially the same for the right hand dominant configuration and for the left hand dominant configuration.

9. The method of claim **8** wherein the receiving information from one of a right optical sensor of a keyboard and a left optical sensor of the keyboard comprises receiving a signal corresponding to sweeping of an object across the one optical sensor.

10. One or more non-transitory computer-readable storage media comprising computer-executable instructions to instruct a computer to:

receive a signal from one of a right optical sensor of a keyboard and a left optical sensor of the keyboard;

responsive to receipt of the signal assign the right and left optical sensors as right hand dominant based on sensed optical information received from the right optical sensor that corresponds to an assignment criterion or as left hand dominant based on sensed optical information received from the left optical sensor that corresponds to the assignment criterion and assign, for a right hand dominant configuration, the right optical sensor to be a primary sensor and the left optical sensor to be a modifier sensor and, for a left hand dominant configuration, the left optical sensor to be the primary sensor and the right optical sensor to be the modifier sensor;

receive information from the primary sensor and from the modifier sensor; and

output one or more commands according to a command correspondence based on sensed input optical information from the primary sensor and sensed input optical information from the modifier sensor; wherein the command correspondence is substantially the same for the right hand dominant configuration and for the left hand dominant configuration.

* * * * *